UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

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MEMORANDUM

DATE: March 8, 2011

SUBJECT: Ecological Risk Assessment for Dicamba and its Degradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed New Use on Dicamba-Tolerant Soybean (MON 87708).

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(for I Maher) 3-8-11

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3/8/11

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3-8-11

The Environmental Fate and Effects Division (EFED) has completed a review of the new use request for the herbicide dicamba [M1691 Herbicide, EPA Reg. No. 524-582 (56.8% diglycolamine salt of dicamba (DGA); PC code 128931)] for use on dicamba-tolerant soybeans (MON 87708). Dicamba is currently registered for use on soybeans at applications rates similar to those proposed for the new use. The use of dicamba on soybeans was assessed by the Environmental Fate and Effects Division (EFED) in 2005 (USEPA, 2005, D317696). The primary difference between the proposed new use on soybeans and the previous soybean use assessed is the timing of the applications. The current registration for dicamba use on soybeans is limited to pre-emergence applications; however, for the proposed new use on dicamba-tolerant soybeans, dicamba could be applied pre-emergence and/or post-emergence. Therefore, an abbreviated ecological risk assessment is provided. Details on the fate and transport properties and effects data for dicamba can be found in the attached assessments.

Based on the proposed maximum application rates, there is a potential for direct adverse effects

to listed and non-listed birds (acute exposure), listed and non-listed mammals (chronic exposure), listed vascular aquatic plants, and listed and non-listed terrestrial dicots from the proposed new use. This assessment uses new submitted information on the toxicity of diglycolamine salt of dicamba (DGA) to terrestrial plants. Although for monocots toxicity of the DGA salt formuation is decreased compared to TGAI dicamba acid, the vegetative vigor data indicate that toxicity in the DGA salt formulation is enhanced for dicots. It is unclear if the enhanced toxicity to dicots is due to synergistic effects with surfactants and adjuvants in the formulation used (Clarity Herbicide, EPA Reg No. 7969-137, 56.8% DGA salt) or due to the DGA salt itself. The study with TGAI dicamba acid did not use surfactants or adjuvants. Although levels of concern were not exceeded for listed and non-listed species of monocots, exceedances for monocots would occur if toxicity data for dicamba acid was used in place of the data for the DGA salt. Risks to aquatic animals from chronic exposure to dicamba could not be assessed at this time because of a lack of data; therefore, since risk to these taxa cannot be precluded, it is assumed.

At this time, no federally-listed taxa can be excluded from the potential for direct and/or indirect effects from the proposed new use of dicamba, since there is a potential for indirect effects to taxa that might rely on plants, birds, aquatic animals, and/or mammals for some stage of their life-cycle. A complete co-occurrence analysis could not be completed for listed species at this time, since the specific use site associated with the proposed new use of dicamba (dicamba-tolerant soybeans) is not available for analysis in LOCATES. Therefore, without further refinement, no species currently listed as federally threatened or endangered can be excluded from the potential for adverse effects from the proposed new use of dicamba. Details regarding the environmental fate, ecological effects and ecological risks associated with the proposed new uses of dicamba are discussed in the sections that follow.

The following studies are identified as data gaps for dicamba and should be required to address the uncertainties described in this assessment:

850.1400	Chronic freshwater fish toxicity (TGAI)
850.1300	Chronic freshwater invertebrate toxicity (TGAI)
850.1400	Chronic estuarine/marine fish toxicity (TGAI)
850.1350	Chronic estuarine/marine invertebrate toxicity(TGAI)
850.2200	Avian acute oral toxicity (with a passerine species)
850.4250	Terrestrial plant toxicity (Tier II vegetative vigor, with lettuce using TEP)
850.5400	Green algae toxicity (TGAI)

Bridging data were submitted indicating that the dicamba salts will be rapidly converted to the free acid of dicamba (MRID 43288001). Additionally, effects data provided indicate equatoxicity of the acid and salts (based on acid equivalents). EFED determined that fate studies conducted with dicamba acid provide "surrogate data" for the dicamba salts and that toxicity data across the acid and salts could generally be combined.

Although the risks, based on standard risk assessment methods used by the Environmental Fate and Effects Division (EFED), are not expected to differ from the previous assessment done for dicamba use on soybeans (because the rates are similar to those already assessed), there is potential for other ecological concerns that would not normally be captured using our standard

risk assessment methods. These concerns are related to a potential increase in usage of dicamba products and the proposed changes in the timing of applications. In general, there is also a potential for increased susceptibility of late season plants to direct impact from off-site transport. Thus, unlike previous assessments of dicamba the risk conclusions in this assessment have increased uncertainty.

PROBLEM FORMULATION

Dicamba was first registered in the United States in 1967 and is widely used in agricultural, industrial and residential settings. Dicamba is a benzoic acid herbicide similar in structure and mode of action to phenoxy herbicides. Dicamba controls annual, biennial and perennial broadleaf weeds in crops and grasslands, and it is used to control brush and bracken in pastures. Dicamba is formulated primarily as a salt in an aqueous solution. Supported forms are: dicamba acid (29801), dicamba dimethylamine salt - DMA (29802), dicamba sodium salt (29806), dicamba diglycoamine salt - DGA (128931), dicamba isopropylamine salt (128944) and dicamba potassium salt (129043).

This assessment is for the new use request for the herbicide dicamba [M1691 Herbicide, EPA Reg. No. 524-582 (56.8% diglycolamine salt of dicamba (DGA); PC code 128931)] for use on dicamba-tolerant soybeans (MON 87708). Dicamba is currently registered for use on soybeans at applications rates similar to those proposed for the new use. The primary difference between the proposed new use on soybeans and the one proposed here is the timing of the applications. The current registration for dicamba use on soybeans is limited to pre-emergence applications. For the proposed new use on dicamba-tolerant soybeans, dicamba could be applied pre-emergence and/or post-emergence. Additionally, the maximum current application rate for soybeans (single application and maximum yearly applications) is 2.0 lb acid equivalent (a.e.)/acre. For the proposed new use on dicamba-tolerant soybeans, the maximum single application rate is 1 lb a.e./acre and the maximum yearly application rate is 2.0 lb a.e./acre.

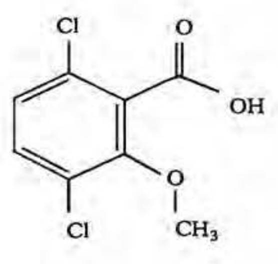
The major degradate under anaerobic conditions is 3,6-dichlorosalicylic acid (DCSA) which is persistent, comprising > 60% of the applied after 365 days of anaerobic incubation in sediment:pond water system (Stable, MRID 43245208). DCSA is formed in aerobic soil under laboratory conditions at the maximum of 17.4 % of the applied parent. Toxicity data for DCSA and mammals have been submitted to the Agency. Based on available data, DCSA appears to be less toxic or equally toxic as the parent (see **Table 1**). Therefore, this assessment will consider the parent and its degradate DCSA (with the assumption that dicamba and DCSA are equatoxic).

TABLE 1. Toxicity Data for the Dicamba Degradate DCSA (no registrant-submitted toxicity data are available for the degradate).

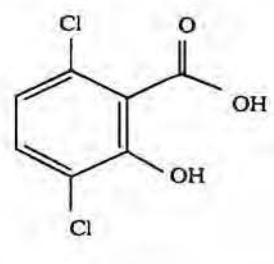
SOURCE	DICAMBA	DCSA
SUBMITTED DATA (Most Sensitive)		
Acute oral Rat (LD_{50}; mg/kg-bw)	2,740	2,641 (MRID 47899504)
Chronic rat (NOAEC; mg/kg-bw)	45 (based on decreased pup weight at 136 mg a.e./kg-bw)	37 (based on decreased parental body weight) (MRID 47899517)
Acute oral Avian (LD_{50}; mg/kg-bw)	188	--
Acute Fish (LC_{50}; mg/L)	28	--
Chronic Fish (NOAEC; mg/L)	--	--
Acute FW Invertebrate (EC_{50}; mg/L)	34.6	--
Chronic FW Invertebrate (NOAEC; mg/L)	--	--
NV Aquatic Plant (EC_{50}; mg/L)	0.061	--
V Aquatic Plant (EC_{50}; mg/L)	>3.25	--
Acute Honeybees (LD_{50}; µg/bee)	>90.65	--
PPDB (EU) WEBSITE[1]		
Acute oral Rat (LD_{50}; mg/kg-bw)	1,581	>1,560
Acute oral Avian (LD_{50}; mg/kg-bw)	1,373	--
Acute Fish (LC_{50}; mg/L)	>100	>100
Chronic Fish (NOAEC; mg/L)	--	--
Acute FW Invertebrate (EC_{50}; mg/L)	>110.7	89
Chronic FW Invertebrate (NOAEC; mg/L)	97	--
NV Aquatic Plant (EC_{50}; mg/L)	1.8	138
V Aquatic Plant (EC_{50}; mg/L)	>3.25	>73
Acute Honeybees (LD_{50}; µg/bee)	>100	--
Acute Earthworms (LC_{50}; mg/kg)	>1,000	>1,000

1 Pesticide Properties Database (PPDB) (http://sitem.herts.ac.uk/aeru/footprint/en/index.htm)

Figure 1: Chemical Structures for Dicamba and its Degradate DCSA



Dicamba
3,6-dichloro-o-anisic acid



DCSA
3,6-dichlorosalicylic acid

BACKGROUND

The most recent regulatory actions for dicamba include the following:

- US EPA/EFED (2010) Reduced Risk Request for Dicamba Herbicide Over-The-Top of Dicamba-Tolerant Soybean. May 27, 2010.

- US EPA. (2010) EFED Response to a FIFRA Section 18 Emergency Exemption for Dicamba co-formulated with 2,4-D (Latigo™) Use on Teff grown for grain, seed, and hay to control broadleaf weeds. Requested by the Oregon Department of Agriculture. May 24, 2010. D377095

- US EPA (2006) Reregistration Eligibility Decision for Dicamba and Dicamba Salts. June 8, 2006.

- US EPA (2005) Drinking water assessment for dicamba on sugarcane. May 31, 2005. D317705

- US EPA (2005) EFED Reregistration Chapter for Dicamba/Dicamba Salts. August 31, 2005. D317696

Consistent with the previous assessments, the environmental fate and effects data used in this assessment will be bridged across the dicamba acid and all of the supported dicamba salts (MRID 43288001). EFED established a strategy for bridging the environmental fate and effects data requirements for the dicamba sodium and potassium salts, dimethylamine salt (DMA), isopropylamine salt and diglycoamine salt (DGA) to the dicamba acid. Bridging data were submitted indicating that the dicamba salts will be rapidly converted to the free acid of dicamba. Additionally, effects data provided indicate equatoxicity of the acid and salts (based on acid equivalents). EFED determined that fate studies conducted with dicamba acid provide "surrogate data" for the dicamba salts and that toxicity data across the acid and salts could generally be combined.

MODE OF ACTION

Dicamba is a benzoic acid herbicide similar in structure and mode of action to phenoxy herbicides. Like the phenoxy herbicides, dicamba mimics auxins, a type of plant hormone and causes abnormal cell growth by affecting cell division. Dicamba acts systematically in plants after it is absorbed through leaves and roots. It is easily transported throughout the plant and accumulates in new leaves.

USE CHARACTERIZATION

Monsanto Company submitted a new use request for the herbicide dicamba [M1691 Herbicide, EPA Reg. No. 524-582 (56.8% diglycolamine salt of dicamba)] for use on dicamba-tolerant soybeans (MON 87708). M1691 Herbicide is a water-soluble formulation intended for control and suppression of many broadleaf weeds, woody brush and vines. **Table 2** presents the

proposed application rates to the dicamba-tolerant soybean. Rates for dicamba salts are normalized to dicamba acid equivalent per acre (a.e./A).

Product Information
Product Name: M1691 Herbicide
Active Ingredient: Diglycolamine salt of dicamba (3,4-dichloro-o-anisic acid)*............56.8%
Other Ingredients..43.2%
Total...100.0%
*Contains 38.5%, 3,6-dichloro-o-anisic acid (4 pounds acid equivalent per US gallon or 480 grams per liter).

TABLE 2. Dicamba DGA Proposed[1] Use Pattern for Dicamba-Tolerant Soybean.

Crop	Maximum Individual Application Rate[3] lbs dicamba a.e./A		Number of Applications	Minimum Application Interval (days)	Max Annual Application Rate in lbs dicamba a.e./A/year		Application Method
Dicamba-tolerant soybean MON 87708	Pre-emergence (pre-plant, at planting, or prior to crop emergence)[2]	1.0	NS	Pre-plant, at planting or prior to crop emergence	1.0	2.0	Ground spray
	Post-emergence[1] (Preharvest)	0.5	2[4]	From V3 (emergence) to before R1 (early flower) reproductive stage of soybean	1.0		

[1]- M1691 Herbicide
[2]- Registered uses
[3]- "Acid equivalent"
[4]- Calculated by dividing the max application rate by the max individual application rate.

Proposed preharvest interval for soybean forage and hay are 7 and 14 days, respectively. The herbicide can be tank mixed with other products. According to the proposed label, aerial applications of dicamba to dicamba-tolerant soybeans is not allowed (*i.e.*, it is limited to ground applications).

Currently, BASF maintains registration for dicamba as the dimethylamine (DMA), diglycolamine (DGA), isopropylamine (IPA), sodium (NA) and potassium (K) salts. To date dicamba salts have registered uses on right-of-way areas, asparagus, barley, corn, grasses grown in pasture and regland, oats, proso millet, rye, sorghum, soybeans (preemergent), sugarcane, wheat, and uses on golf courses and residential loans. Chemical structures of dicamba salts are provided in Table 1, Attachment I.

The proposed dicamba registration is for use on dicamba-tolerant soybean (MON 87708). Dicamba-tolerant soybeans (MON 87708) are not currently available for sale in the United States, therefore, maps of specific use-sites are not available. However, maps for soybean acreage can be used as a proxy under the assumption that dicamba-tolerant soybeans could be grown wherever soybeans are grown. Based on National Agricultural Statistics Service (NASS) 2009 data, soybeans are grown primarily in the central portions of the United States (see **Fig. 2**). These represent potential use sites for use of dicamba on dicamba-tolerant soybeans.

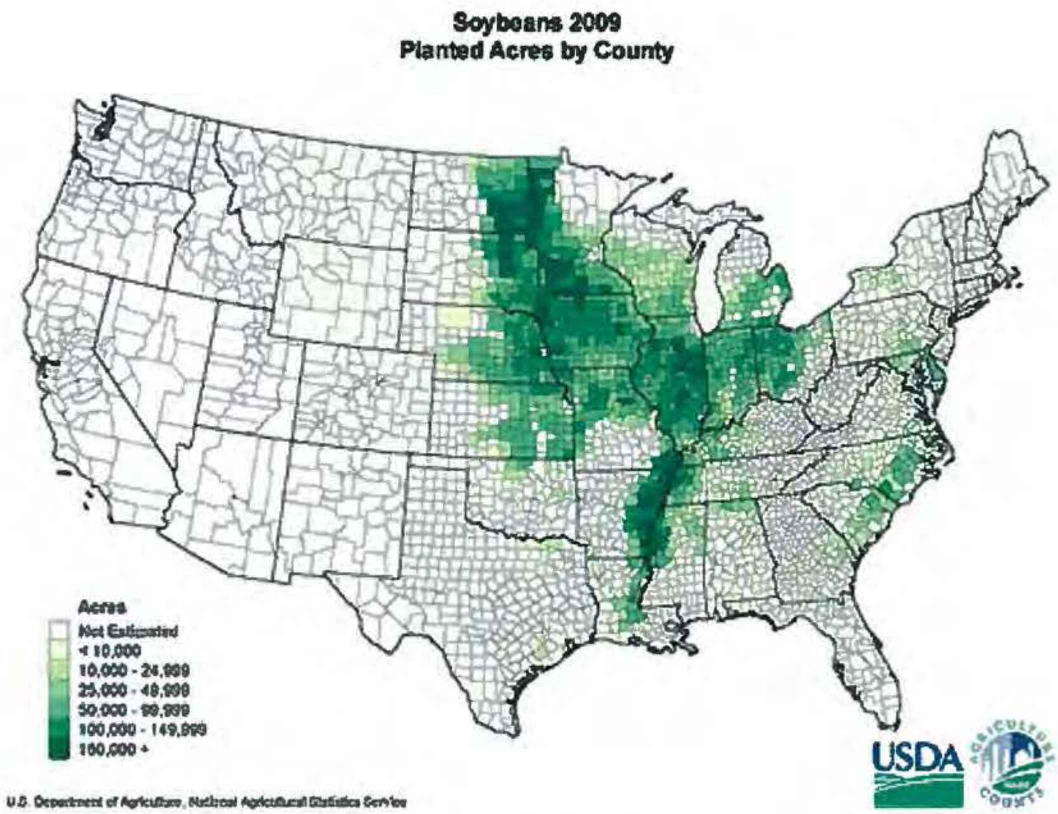


FIGURE 2. Acres of Soybeans Grown By County in the United Stated in 2009 (based on information from USDA-NASS) (http://www.nass.usda.gov/Charts_and_Maps/Crops_County/sb-pl.asp).

ENVIRONMENTAL FATE CHARACTERISTIC

Dicamba is a benzoic acid herbicide applied to leaves or to soil as a growth regulator, and is absorbed by leaves and roots moving throughout the plant. In some plants, it may accumulate in the tips of leaves. Some plants can metabolize or break down dicamba.

Dicamba is very soluble (6,100 ppm) and very mobile (K_{oc} = 13.4) in the laboratory, and is not expected to bioaccumulate in aquatic organisms because it is an anion at environmental pHs (pKa = 1.9). The active ingredient can reach surface water via run-off, spray drift during application, and vapor drift/volatilization. Multiple literature studies show that there is a high vapor drift from soybean fields resulting in non-target plant injury[1]. Since dicamba is not persistent under aerobic conditions, very little dicamba is expected to leach to groundwater. In two acceptable field dissipation studies conducted with dimethylamine salt of dicamba, dicamba was found in soil segments deeper than 10 cm (half-life range = 4.4 to 19.8 days, MRID 43651405, MRID 43651407). Any dicamba reaching anaerobic ground water would be

[1] Al-Khatib and Tamhane, 1999; Auch and Arnold, 1978; Everitt and Keeling, 2009; Kelley et al., 2005; Hamilton and Arle, 1979; Lanini, 2000; Marple et al., 2008; Wall, 1994; Weidenhamer et al., 1989; Wax et al., 1969.

somewhat persistent (due to its anaerobic half-life of 141 days).

Aerobic soil metabolism is the main degradative process for dicamba (6 days, MRID 43245207). Dicamba is stable to abiotic hydrolysis at all pH's and photodegrades slowly in water and on soil and is more persistent under anaerobic conditions in soil:water systems in the laboratory (141 days, MRID 43245208). A supplemental aerobic aquatic metabolism study of dicamba indicates that dicamba degrades more rapidly in aquatic systems when sediment is present. Its aerobic soil metabolism half-life in sediment:water system is about 24 days.

The major degradate under anaerobic conditions is 3,6-dichlorosalicylic acid (DCSA) which is persistent, comprising > 60% of the applied after 365 days of anaerobic incubation in sediment:pond water system (Stable, MRID# 43245208). DCSA is non-persistent when formed under aerobic conditions and degrades roughly at the same rate as the parent (8.2 days, MRID 43245207). DCSA was also found in the two acceptable field studies in soil segments deeper than 10 cm, and is believed to be persistent if it was to reach anaerobic ground water. The degradate is formed in aerobic soil under laboratory conditions at the maximum of 17.4 % of the applied parent. Other minor dicamba degradates of concern are DCGA and 5-OH-dicamba, and both are less toxic than the parent and DCSA. The formation of DCGA in the laboratory studies did not exceed 3.64%, and the formation of 5-OH dicamba did not exceed 1.9 % in soil/water system during anaerobic aquatic degradation of dicamba under laboratory condition.

Dicamba nomenclature including selected physical-chemical and fate properties for dicamba are provided below in Table 3. Chemical structures of dicamba and dicamba salts are presented in Table 1, Attachment I. The maximum percent formations of dicamba's metabolites are provided in Table 2, Appendix I. Further details regarding fate and transport laboratory and field studies submitted for dicamba can be found in the EFED Reregistration Chapter (US EPA, 2005).

TABLE 3. Selected Physical-Chemical and Fate Properties of Dicamba Acid.

CAS Name	3,6-dichloro-2-methoxybenzoic acid
IUPAC Name	3,6-dichloro-o-anisic acid
CAS No	1918-00-9
PC Code	029801
Empirical Formula	$C_8H_6Cl_2O_3$
Molecular Weight	221.04
Common Name	Dicamba
Formulated Product	Banex; Banlen; Banval; Banvel; Banvel 10G; Banvel 4E; Banvel 5G; Banvel CST; Banvel D; Banvel XG; dianat; Dicambe; Dicamba; Dicamba ; dicamba + 2,4-D; dicamba + atrazine; dicamba (amine); Clarity; Marksman; MDBA; Mediben; Velsicol 58-CS-11; Velsicol compound "R"
Pesticide Type	Herbicide
Chemical Family	Benzoic acid
Color/Form	Colorless crystals
Odor	Odorless
Melting Point	114 - 116°C (Kidd and James, 1991))

Flash Point	199°C (Gosselin, 1984)
Relative Density	1.57 g/ml at 25°C (Spectrum Laboratories: Chemical Fact Sheet)
Water Solubility	6100 mg/L SANDOZE Safety Data Sheet (Nov, 1989) 8240 mg/L at 25°C (Toxicology and Regulatory Affairs Flemington, NJ) 6500 mg/L at 25°C (Kidd and James, 1991)
Solubility in other solvents	Acetone 810 g/L at 25°C Dichloromethane 260 g/L at 25°C Dioxane 1.18 kg/L at 25°C Ethanol 922 g/L at 25°C Toluene 130 g/L at 25°C Xylene 8 g/L at 25°C (Worthing 1987)
Vapor Pressure	3.41 E-05 torr (25°C) SANDOZE Safety Data Sheet (Nov, 1989) 3.4 E-05 torr (25°C) (Kidd and James, 1991))
Henry's Law Constant	1.79 E-08 (ARS Pesticide Properties Database)
pKa	1.87 (MRID 43288001)
K_d(Freundlich) K_{oc}	0.07 - 0.53 mL/g (MRID 42774101) 3.45 - 21.1 mL/g (MRID 42774101)

Aquatic Exposure Estimates

The Tier II modeling was performed for dicamba acid and its major degradate DCSA using PRZM (v3.12.2; May 12, 2005)/EXAMS (v. 2.98.04.06; April 25, 2005) coupled with the standard pond scenario. Standard Mississippi soybean scenario was selected to assess runoff potential from vulnerable use sites. The modeling scenario for DCSA was based on the following: (1) assuming 17.4% conversion from parent DCSA and (2) using molecular weight conversion to adjust from parent application rate to DCSA application rate. **Tables 4** and **5** list the input parameters used for the PRZM/EXAMS modeling of dicamba acid and DCSA degradate.

TABLE 4. PRZM/EXAMS Input Parameters for Dicamba.

Model Input Variable	Input Value	Source and Comments	
Application rate (kg ai/hectare)	Soybean: 1.12; 0.56; 0.56	M1691; EPA Reg. No. 524-582	
Number of appl./season	Soybean: 3	M1691; EPA Reg. No. 524-582	
Interval between appl. (d)	3 days	M1691; EPA Reg. No. 524-582	
Application Method	Soybean: Ground	M1691; EPA Reg. No. 524-582	
Scenario modeled (Metfile) - Initial Application Date	MSsoybeanSTD (W03940.dvf) - 16 April		Dates based on the crop profile, date of planting, & precipitation data.
Henry's Law Constant (atm m^3/mol)	1.6×10^{-9}	Estimated (VP x MW)/(760 torr/1 atm * solubility)	
Molecular Weight (g/mol)	221	SANDOZE Safety Data Sheet (Nov, 1989).	
Solubility @ 25°C (mg/L)	6100	SANDOZE Safety Data Sheet (Nov, 1989).	
Vapor Pressure (torr)	3.41×10^{-5}	SANDOZE Safety Data Sheet (Nov, 1989).	

K_{oc} (mL/g)	13.4 (average)	MRID 42774101; Input parameters guidance (10/22/2009).
Aerobic Soil Metabolic Half-life (days)	18	MRID 43245207; (6d x 3) input parameters guidance (10/22/2009).
Is the pesticide wetted-in?	No	EPA Reg. No. 5905-564
Spray Drift Fraction	0.01 ground	Input guidance, 2009
Application Efficiency	0.99 ground	Input guidance, 2009
Aerobic Aquatic Metabolic Half-life (days)	72.9	MRID 43758509; 3x a single half-life value of 24.3 days was used per guidance (Input guidance, 2009).
Anaerobic Aquatic Metabolic Half-life (days)	423	A single half-life value was available (MRID 43245208); 3x the half-life value (141 x 3 = 423) was used per Input Parameter Guidance 2009.
Hydrolysis (pH 7) half-life (days)	0	Stable. MRID 40547902
Aquatic Photolysis Half-life (days)	105	MRID 42774102. Input Parameter Guidance 2009. Adjusted half-life to represent sun intensity and 12 hours of sunlight per day. 38.1 day value represented continuous sun exposure at an intensity of 1.38 times natural sunlight. Degradate not present.

Table 5. PRZM/EXAMS Input Parameters for DCSA.

Model Input Variable	Input Value	Source and Comments
Application rate (kg ai/hectare)	Soybean: 0.18; 0.09; and 0.09	(degradate molecular weight)/(parent molecular weight) x max%formation x application rate = (207/221)x 0.174 x 1.12
Number of appl./season	Soybean: 3	EPA Reg. No. 524-582
Interval between appl. (d)	3 days	EPA Reg. No. 524-582
Scenario modeled (Metfile) -Initial Application Date	MSsoybeanSTD (W03940.dvf) - 16 April	Dates based on the crop profile, date of planting, & precipitation data.
Henry's Law Constant (atm m^3/mol)	1.6×10^{-9}	Estimated for dicamba and used for DCSA (VP x MW)/(760 torr/1 atm * solubility)
Molecular Weight (g/mol)	207	Product Chemistry
Solubility @ 25°C (mg/L)	2112	MRID 43095301
Vapor Pressure (torr)	3.41×10^{-5}	For Dicamba. SANDOZE Safety Data Sheet (Nov, 1989).
K_{oc} (mL/g)	1208 (average)	MRID 43095301; Input parameters guidance (10/22/2009).
Aerobic Soil Metabolic Half-life (days)	24.6	MRID 43245207; (8.2 d x 3) (Input Parameters Guidance; 10/22/2009).
Is the pesticide wetted-in?	No	EPA Reg. No. 524-582
CAM	1	DCSA formed from parent in the top soil layer
Spray Drift Fraction	0	Assumed formed in the soil
Application Efficiency	1.0	Assumed formed in the soil
Aerobic Aquatic	49.2	No acceptable data were available; 2x the half-life corresponding to the PRZM aerobic soil metabolism rate

Metabolic Half-life (days)		input value (2x 24.6d) was used per guidance (Input guidance, 2009).
Anaerobic Aquatic Metabolic Half-life (days)	0	Stable. MRID 43245208. Input Parameter Guidance 2009.
Hydrolysis (pH 7) Half-life (days)	0	Stable. MRID# 43245208
Aquatic Photolysis Half-life (days)	105	No data for DCSA; therefore, used value for dicamba: MRID 42774102. Input Parameter Guidance 2009. Adjusted half-life to represent sun intensity and 12 hours of sunlight per day. 38.1 day value represented continuous sun exposure at an intensity of 1.38 times natural sunlight.

PRZM-EXAMS Modeling Output

Table 6 presents combined PRZM/EXAMS estimated environmental concentrations in surface water for dicamba acid and the DCSA degradate for the proposed use on dicamba-tolerant soybean. These estimated environmental concentrations (EECs) were used to calculate risk to aquatic animals and plants.

The 1-in-10-year peak concentration for dicamba acid for modeled soybean scenario is 38 µg/L, the 21-day average concentration is 36 µg/L, and the 60-day average concentration is 31 µg/L. Table 6 provides combined EECs for dicamba parent and DCSA degradate. The PRZM/EXAMS output files are provided in the **APPENDIX II.**

TABLE 6. Combined PRZM/EXAMS Estimated Environmental Concentrations (EECs) for Dicamba Acid and DCSA Degradate.

Scenario	Estimated Water Concentrations (µg/L)		
	1-in-10-year Peak EEC	1-in-10-year 21-day mean EEC	1-in-10-year 60-day mean EEC
Dicamba and DCSA[1]			
MS Soybean – water column	40.3	37.9	33.1
[1] The EEC presents a combined value for the parent and degradate			

ASSUMPTIONS AND UNCERTAINTIES

The following uncertainties have been identified in the environmental fate properties and aquatic assessment for dicamba and its degradate DCSA:

- The proposed label does not specify the minimum application interval between the consecutive applications, but the approximate growth stage of the plant. Therefore, for this assessment, it was assumed that the minimum application interval between the consecutive applications is 3 days.

- DCSA percent formation used for the modeling "application rate" calculation was based on the amount of degradate formed in the aerobic soil metabolism conducted on silt loam soil. It

is possible that DCSA maybe formed in different amounts in different soil types, and result in DCSA EECs being underestimated. The use of 100% conversion from the parent to DCSA, however, was not pursued herein as this approach would be overly conservative.

- The PRZM/EXAMS aerobic aquatic metabolism input parameter is based on a supplemental study, although there are uncertainties associated with the aerobic aquatic metabolism half-life (MRID 43758509), the input parameter is more conservative than the one previously used in the aquatic assessments (US EPA, 2010).

MONITORING DATA

Surface water and groundwater monitoring data from the United States Geological Survey (USGS) NAWQA program was accessed on November 16, 2010 and all filtered water data (.7 micron glass fiber filter) were downloaded. A total of 14163 water samples from 6243 sites were analyzed for dicamba. Of these samples, 268 (3.4%) out of 7822 samples had positive detections of dicamba in surface water, and five out of 6341 samples in groundwater. The maximum concentration detected in filtered water from surface water was 1.76 µg/L in the Rocky Creek at State Hwy 587 at Citrus Park, Hillsborough County, Florida. Dicamba was detected in the Zollner Creek near Mt Angel, Oregon (agricultural area), in 19 samples with concentrations ranging 0.0097 -0.3775 µg/L and in the White Rock Creek at Greenville Ave, Dallas, Texas (urban area), in 16 samples with concentrations ranging from 0.0113 -0.3175 µg/L. The maximum estimated concentration detected in the filter groundwater was 4.03 µg/L in urban area (SH:UR-18) in Shelby, Tennessee. Overall the filtered surface water samples were detected at various areas with concentrations ranging 0.0094 -1.76µg/L, while groundwater filtered samples with concentration ranging 4.03 (estimated value)-0.14 µg/L. No clear pattern in dicamba detections from different use sites is evident because dicamba was detected in a number of different types of watersheds (agricultural, urban, mixed and other) as classified by the USGS land use information. Most of this data is non-targeted (*i.e.*, study was not specifically designed to capture dicamba concentrations in high use areas). Typically, sampling frequencies employed in monitoring studies are insufficient to document peak exposure values. This coupled with the fact that these data are not temporally or spatially correlated with dicamba application times and/or areas limit the utility of these data in estimating exposure concentrations for risk assessment.

Monitoring data are available in the Pesticides in Ground Water Database [Hoheisel *et al.* 1991] for dicamba (3,172 wells sampled) and 5-hydroxy dicamba (87 wells sampled). Out of the wells sampled, there were no reports of residues greater than the stated MCL (200 µg/L lifetime). However, the detection limits are unknown, and it is not known if wells were sampled in areas where dicamba was used. STORET contains records for sampling for dicamba in samples from lakes, ocean, estuary, canal, or reservoir sites. The data have not been extensively evaluated; in addition, it is uncertain what the actual detection limits were for the samples and whether samples were taken from areas where dicamba was not in use.

ENVIRONMENTAL EFFECTS DATA

Assessment of risk is based on the most sensitive species tested for terrestrial and aquatic

organisms. The acute and chronic toxicity values for the most sensitive terrestrial and aquatic organisms tested are presented in **Table 7**. These endpoints are based on those presented in the most recent assessment conducted for dicamba, except for the terrestrial plant endpoints (USEPA 2010, D029801). The risks to terrestrial plants were evaluated using new toxicity information from a seedling emergence (MRID 47815101) and vegetative vigor (MRID 47815102) terrestrial plant studies conducted with a typical end-use product (TEP) representative of the product being proposed here for use on dicamba-tolerant soybean. The new vegetative vigor study was determined to be supplemental due to a decrease in plant height in lettuce controls. Quantitative data for the other nine species in the study may be used in risk assessment, but the endpoints for lettuce may not be used in risk assessment. The new data indicates that the DGA salt may be less toxic to monocots, but has an EC_{25} approximately 13 times more toxic to the vegetative vigor of dicots than dicamba acid. It is unclear if the enhanced toxicity to dicots is due to synergistic effects with surfactants and adjuvants in the formulation used (Clarity Herbicide, EPA Reg No. 7969-137, 56.8% DGA salt) or due to the DGA salt itself.

TABLE 7. Toxicity Values Used to Assess Risks from Use of Dicamba.

SPECIES	ACUTE ENDPOINT	NOAEC	MRID
Rainbow trout (*Oncorhynchus mykiss*)	LC_{50} = 28 mg a.e./L	No data available	40098001[1]
Sheepshead minnow (*Cyprinodon variegates*)	LC_{50} > 180 mg a.e./L	No data available	000253901
Water flea (*Daphnia magna*)	EC_{50} > 100 mg a.e./L	No data available	40094602
Grass shrimp (*Palaemonetes purgio*)	EC_{50} > 100 mg a.e./L	No data available	00034702
Duckweed (*Lemna gibba*)	IC_{50} > 3.25 mg a.e./L	NOAEC = 0.20 mg a.e../L	42774111
Blue-green algae (*Anabaena flos-aquae*)	IC_{50} = 0.061 mg a.e./L	NOAEC = 0.005 mg a.e./L	42774109
Bobwhite quail (*Colinus virginianus*) or Mallard duck (*Anas platyrhynchos*)	LD_{50} = 188 mg a.e./kg-bw (quail) LC_{50} > 10,000 mg a.e./kg-diet (quail)	NOAEC = 800 mg a.e./kg-diet (duck) (based on a reduction in hatchability at 1,600 mg a.e./kg-diet)	42918001, 00025391, 43814003
Rat (*Rattus norvegicus*)	LD_{50} = 2,740 mg a.e./kg-bw	NOAEL = 45 mg a.e./kg-bw (based on decreased pup weight at 136 mg a.e./kg-bw)	00078444, 43137101
Honey bee (*Apis mellifera*)	LD_{50} > 91 µg a.e./bee	No data available	00036935
Dicot (Tomato, *Lycopersicon esculentum*) – seedling emergence	EC_{25} = 0.123 lbs ae/A	NOAEC = 0.0673 lbs ae/A	47815101
Monocot (Onion, *Allium cepa*) – Seedling Emergence	EC_{25} = 1.68 lbs ae/A	NOAEC = 0.64 lbs ae/A	47815101
Dicot (Soybean, *Glycine max*) – Vegetative Vigor	EC_{25} = 0.000513 lbs ae/A	EC_{05} = 0.000013 lbs ae/A	47815102[2]
Monocot (Onion, *Allium cepa*) – Vegetative Vigor	EC_{25} = 0.472 lbs ae/A	EC_{05} = 0.137 lbs ae/A	47815102[2]

[1] The raw data from this study (Mayer and Ellersieck, 1986; MRID 40098001) were not available for review. Therefore, per current EFED policy regarding the results from this study, the study was classified as 'supplemental'.
[2] Currently in review.
"a.e." = acid equivalent.

RISK ESTIMATION & CHARACTERIZATION

Aquatic Organisms

The only acute RQ that could be calculated for aquatic animals based on available data is for freshwater fish [specifically rainbow trout (*Oncorhynchus mykiss*) (MRID 40098001)]. The acute RQ for freshwater fish is <0.01 for both dicamba (37.9 µg a.e./L divided by 28,000 µg a.e./L) and DCSA (2.4 µg a.e./L divided by 28,000 µg a.e./L). The results from the remaining acute aquatic animal studies are from limit tests and are non-definitive (*i.e.*, the LC_{50}/EC_{50}'s are 'greater than' values); therefore, acute RQs cannot be calculated using these data.

In order to gain a better understanding of how the EECs for the maximum proposed dicamba application rate for soybeans relate to the toxicity data currently available for aquatic animals, we compared the EECs to the toxicity endpoints using the conservative assumption that the highest concentrations tested in the acute aquatic animal studies represent endpoints (*e.g.*, acute: LC_{50} = 100 mg a.e./L). In this exercise, none of the acute RQs for estuarine/marine fish or aquatic invertebrates (freshwater and estuarine/marine) would exceed an Agency level of concern (LOC) for dicamba or DCSA (they are all <0.01).

Risks to aquatic animals from chronic exposure to dicamba could not be assessed at this time because of a lack of data. Since risk cannot be precluded, it is assumed.

For aquatic plants the only RQ that exceeds an Agency LOC is for listed non-vascular aquatic plants and dicamba (RQ = 7.6) (see **Table 8**). The results from the available vascular aquatic plant study are non-definitive (*i.e.*, the IC_{50}' is a 'greater than' value); therefore, a non-listed species RQ cannot be calculated using these data. In order to gain a better understanding of how the EECs for the maximum proposed dicamba application rate for soybeans relate to the toxicity data currently available for aquatic vascular plants, we compared the EECs to the toxicity endpoints using the conservative assumption that the highest concentration tested in the vascular aquatic plant study represents the endpoint (*i.e.*, IC_{50} = 3.25 mg a.e./L). In this exercise, the RQ would not exceed the Agency's level of concern (LOC) for dicamba or DCSA (they are <0.01).

TABLE 8. RQs for Aquatic Plants and the Use of Dicamba on Soybeans.

TAXON	LISTED/NON-LISTED	ENDPOINT (µg a.e./L)	MS -SOYBEANS			
			DICAMBA		DCSA	
			EEC (µg a.e./L)	RQ	EEC (µg a.e./L)	RQ
Vascular Aquatic Plant	Non-listed species	Non-definitive	37.9 (peak)	N/A	2.4 (peak)	N/A
	Listed species	NOAEC = 200	37.9 (peak)	0.2	2.4 (peak)	0.01
Non-Vascular Aquatic Plant	Non-listed species	IC_{50} = 61	37.9 (peak)	0.6	2.4 (peak)	0.04
	Listed species	NOAEC = 5	37.9 (peak)	**7.6**	2.4 (peak)	0.5

Bolded numbers exceed the Agency LOC of '1'.
"a.e." = acid equivalent.
"N/A" = not applicable

Terrestrial Organisms

In the EFED Reregistration Chapter for Dicamba/Dicamba Salts (USEPA 2005; DP 317696), the maximum single application rate assessed was 2.0 lb a.e./acre. The maximum single application rate for the proposed new use of dicamba on dicamba-tolerant soybeans is 1.0 lb a.e./acre, with a maximum yearly application rate of 2.0 lb a.e./acre. The maximum single application rate of 1.0 lb a.e./acre can only be used once; the maximum application rate for subsequent applications is limited to 0.5 lb a.e./acre. T-REX does not currently model RQs for multiple applications that have different single application rates (*i.e.*, when entering the application rate for multiple applications into the model, the application rates must be the same for the RQs to be automatically calculated).

In the previous assessments conducted by EFED (USEPA, 2005, 2010), there were risks to birds (acute - listed and non-listed) and mammals (acute – listed; chronic – listed and non-listed) identified based on LOC exceedences from RQs calculated in T-REX using the 2.0 lb a.e./acre application rate. We re-ran T-REX using the 1.0 lb a.e./acre application rate. At the 1.0 lb a.e./acre application rate, the Agency's acute LOCs are exceeded for listed and non-listed birds [acute dose-based RQs range from <0.01 (1,000 g bird that eats seeds) to 2.0 (20 g bird that eats short grass)] (see **Table 9** and **APPENDIX IV**). No chronic RQs exceed the Agency's LOC for chronic risk (chronic dietary-based RQs range from 0.02 to 0.30).

TABLE 9. Acute Dose-Based RQs for Birds from T-REX for Dicamba Use on Dicamba-Tolerant Soybeans[1].

Dose-based RQs (Dose-based EEC/adjusted LD50)	Avian Acute RQs Size Class (grams)		
	20	100	1000
Short Grass	**2.02**	**0.90**	**0.29**
Tall Grass	**0.92**	**0.41**	**0.13**
Broadleaf plants/sm insects	**1.14**	**0.51**	**0.16**
Fruits/pods/seeds/lg insects	**0.13**	0.06	0.02
Seeds (granivore)	0.03	0.01	0.00

[1] One application at 1.0 lb a.e./acre was modeled
Bolded numbers exceed the Agency's acute risk LOC for non-listed species (RQ > 0.5) and/or the acute risk LOC for listed species (RQ > 0.1).

For mammals, none of the acute RQs exceed any of the Agency's LOCs (acute dose-based RQs range from <0.01 to 0.04). Additionally, none of the dietary-based chronic RQs exceed the Agency's LOCs for chronic risk (chronic dietary-based RQs range from 0.02 to 0.27). Chronic dose-based RQs, however, do exceed the Agency's LOC for chronic risk (chronic dose-based RQs range from 0.01 to 2.3) (see **Table 10** and **APPENDIX IV**).

TABLE 10. Chronic Dose-Based RQs for Mammals from T-REX for Dicamba Use on Dicamba-Tolerant Soybeans[1].

Dose-based RQs (Dose-based NOAEL)	Small mammal 15 grams	Medium mammal 35 grams	Large mammal 1000 grams
Short Grass	**2.31**	**1.98**	**1.06**
Tall Grass	**1.06**	0.91	0.49

Broadleaf plants/sm insects	**1.30**	**1.11**	0.60
Fruits/pods/lg insects	0.14	0.12	0.07
Seeds (granivore)	0.03	0.03	0.01

[1] One application at 1.0 lb a.e./acre was modeled
Bolded numbers exceed the Agency's chronic risk LOC for listed and non-listed species (RQ > 1).

Therefore, there are still risks to birds (acute - listed and non-listed) and mammals (acute – listed; chronic – listed and non-listed) with the single maximum application rate of 1.0 lb a.e./acre.

Based on the available acute toxicity data available for honey bees, dicamba is classified as practically non-toxic to beneficial terrestrial invertebrates.

Terrestrial Plants

Dicamba exposure to terrestrial and semi-aquatic plants is estimated using the TerrPlant (version 1.2.2) model. The model generates EECs for plants residing near a use area that may be exposed via runoff and/or spray drift. The EECs are generated from one application at the maximum rate for a particular use and compound-specific solubility information. Only a single application is considered because it is assumed that for plants, toxic effects are likely to manifest shortly after the initial exposure and that subsequent exposures do not contribute to the response. Hence, the model estimates EECs based on application rate, the solubility factor, and default assumptions of drift. Parameter values for application rate, drift assumption and incorporation depth are based upon the use and related application method and can be found in Appendix V.

The EECs and resulting RQs for terrestrial and semi-aquatic plants for a single application of dicamba DGA at the maximum label rate for the proposed use on dicamba-tolerant soybeans are presented in **Tables 11 and 12.** RQs were exceeded for listed and non-listed dicots due to spray drift or in semi-aquatic areas due to runoff and spray drift.

Table 11. EECs for Terrestrial and Semi-Aquatic Plants Near Dicamba Use on Dicamba-Tolerant Soybeans.

Crop	Single Max. Application Rate (lbs a.e./A)	EECs (lbs a.e./A) Ground Spray		
		Total Loading to Adjacent Dry Areas (sheet runoff + drift)	Total Loading to Semi-Aquatic Areas (Channelzed runoff + drift)	Drift EEC
Dicamba-Tolerant Soybeans	1.0	0.06	0.51	0.01

Table 12. RQ values for plants in dry and semi-aquatic areas exposed to Diglycolamine Salt (DGA) through runoff and/or spray drift.*

Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
Monocot	non-listed	<0.1	0.30	<0.1
Monocot	listed	<0.1	0.80	<0.1

Dicot	non-listed	0.49	**4.15**	**19.49**
Dicot	listed	0.89	**7.58**	**769.23**
*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.				

EFED's current screening tool TerrPlant results in a RQ of 0.89 for listed species and 0.49 for non-listed species of dicots in dry areas, which is less than the LOC for plants of 1.0. However, using AgDrift, with standard default assumptions, the RQ exceeds the listed species LOC at ≤142 feet from the application site. At 100' from the application area, the RQ=1.45 and at 50' from the application area the RQ=2.54. Similarly, using AgDrift, the RQ for non-listed species exceeds the LOC at ≤ 77 feet from the application site. For ground application in dry areas, listed dicot populations must be > 142 feet from the application area to be protected and non-listed dicot populations must be > 77 feet from the application area to be protected. **Table 13** shows the distance from the edge of field (as calculated by AgDrift) where the RQ falls below the risk to terrestrial plant LOCs. Listed plant species that may be similar to tomatoes or soybeans would exceed the LOC even if a 1000' buffer was applied to the application site. These calculations used a default droplet size distribution of fine to medium. Different droplet spectra (e.g. coarser drop size distributions) would yield less spray drift and lower RQs.

The aforementioned RQ values are for the DGA salt of dicamba. For dicamba acid, which DGA salt may dissociate to and which has more sensitive seedling emergence values, RQ values would exceed the LOC of 1.0 for all listed and non-listed monocots and dicots in semi-aquatic areas and for listed monocots and listed and non-listed dicots in dry areas. It is unclear what the differences in observed toxicities of the seedling emergence and vegetative vigor studies between the DGA salt and dicamba acid is due to.

Table 13 Distance (feet) from the edge of field where the RQ falls below the risk to terrestrial plant LOC for seedling emergence and vegetative vigor endpoints for ground application, based on AgDRIFT EECs.

Plant Species	Seedling Emergence		Vegetative vigor	
	Listed	Nonlisted	Listed	Nonlisted
Corn	30	<3.3	<3.3	<3.3
Ryegrass	<3.3	<3.3	<3.3	<3.3
Wheat	<3.3	<3.3	3.3	<3.3
Onion	<3.3	<3.3	7	<3.3
Oilseed rape	233	<3.3	10	<3.3
Soybean	10	3.3	>997	784
Cabbage	<3.3	<3.3	30	<3.3
Carrot	3.3	<3.3	171	13

Plant Species	Seedling Emergence		Vegetative vigor	
	Listed	Nonlisted	Listed	Nonlisted
Lettuce	3.3	<3.3	259	36
Tomato	10	7	>997	538

Incident Data

A preliminary review on February 23, 2011, of the Ecological Incident Information System (EIIS, version 2.1), which is maintained by the Agency's Office of Pesticide Programs, and the Avian Monitoring Information System (AIMS), which is maintained by the American Bird Conservancy, indicates a total of 2 reported ecological incidents associated with the use of DGA salt. This total excludes incidents classified as 'unlikely' or 'unrelated' and only includes those incidents with certainty categories of 'possible', 'probable', and 'highly probable' (for EIIS) and 'possible', 'probable', 'likely', 'highly likely' and 'certain' (for AIMS). Incidents classified as 'unlikely' the result of or 'unrelated' to DGA salt will not be included in this ecological risk assessment.

In 1998, in Lyon County, Minnesota, 120 acres of soybeans were adversely affected after dicamba DGA and clopyralid were applied. The type of injurty was not reported. The incident was classified as probable for both dicamba DGA salt and clopyralid and the incident was considered as an accidental misuse. In 2007, in Imperial County, California, a complaint was received that alfalfa fields were damaged, with dead and stunted plants, and leaves curled and cupped. An application of dicamba DGA salt and 2,4-D DMA salt by air to adjacent fields was conducted, however, samples taken from the affected field were found negative for both dicamba and 2,4-D. This incident was classified possible for Dicamba DGA salt and 2,4-D DMA salt and was considered a registered use.

A review was also briefly conducted on the incident data for dicamba acid. The 2006 RED recorded thirty-five ecological incidents attributed to dicamba acid use having been recorded in the Ecological Incident Information System (EIIS) as of June l, 2005. Since the RED, two additional incidents have been reported. In 2006, in St. Landry County, LA, 1500 acres of soybean were damaged by a combination of glyphosate, dicamba and 2,4-D. The type of injury was not reported. This incident was classified as probable for dicamba and 2,4-D and possible for glyphosate and the incident was considered as an intentional misuse. In 2007, in Lancaster County, PA, 4 rabbits were killed after a homeowner applied product with MCPP, Dicamba, and 2-4 D ingredients to the house lawn. This incident was classified as possible for all three active ingredients and the legality was undetermined. The earlier incidents reported include terrestrial, plant, and aquatic impacts. 19 of the incidents involve 2,4-D in addition to dicamba and sometimes other active ingredients. Although the database lists a terrestrial mammalian incident in Utah where dicamba was applied, the database states that dicamba is "unlikely" to have caused the incident. Impacts to plants included a wide range of crops (soybeans, corn, wheat) as well as non-agricultural applications. The specific impacts varied from browning and plant damage to mortality of all plants within the treated area. Aquatic impacts consist of two fish kill incidents associated with agricultural and residential turf application.

FEDERALLY-LISTED SPECIES

Potential effects to federally-listed endangered and threatened species (listed species) based on LOC exceedances require an in-depth listed species evaluation. Identified potential risks to listed species are summarized in **Table 14.**

TABLE 14. Listed Species Risks Associated with Potential Direct or Indirect Effects Due to the Proposed Applications of Dicamba on Dicamba-Tolerant Soybeans.

LISTED TAXON	DIRECT EFFECTS	INDIRECT EFFECTS
Terrestrial and semi-aquatic plants – monocots	No[1]	Yes[3]
Terrestrial and semi-aquatic plants - dicots	Yes	Yes[3]
Insects	No	Yes[3]
Birds	Yes (Acute)	Yes[3]
Terrestrial phase amphibians	Yes (Acute)	Yes[3]
Reptiles	Yes (Acute)	Yes[3]
Mammals	Yes (Chronic)	Yes[3]
Aquatic plants	Yes (Non-vascular)	Yes[3]
Freshwater fish	Yes (Chronic)[2]	Yes[3]
Aquatic phase amphibians	Yes (Chronic)[2]	Yes[3]
Freshwater crustaceans	Yes (Chronic)[2]	Yes[3]
Mollusks	No	Yes[3]
Marine/estuarine fish	Yes (Chronic)[2]	Yes[3]
Marine/estuarine crustaceans	Yes (Chronic)[2]	Yes[3]

[1]Listed species of monocots RQ values did not indicate risk from DGA salt, but risk was indicated for dicamba acid. DGA salt rapidly disassociates into dicamba acid.
[2] Risks could not be precluded due to a lack of data; therefore, risk is assumed.
[3]The listed chronic LOC was exceeded for fish and mammals. Therefore, the potential for adverse effects to those species that rely on a specific animal species (specifically fish and/or mammals) or multiple animal species (specifically fish and/or mammals) cannot be precluded. Indirect effects may include general habitat modification,

loss of pollinators/seed dispersers, and food supply disruption.

At this time, no federally-listed taxa can be excluded from the potential for direct and/or indirect effects from the proposed new uses of dicamba, since there is a potential for indirect effects to taxa that might rely on plants, birds, aquatic animals, and/or mammals for some stage of their life-cycle. A complete co-occurrence analysis could not be completed for listed species at this time, since the specific use site associated with the proposed new use of dicamba (dicamba-tolerant soybeans). Therefore, without further refinement, no species currently listed as federally threatened or endangered can be excluded from the potential for adverse effects from the proposed new use of dicamba. Details regarding the environmental fate, ecological effects and ecological risks associated with the proposed new uses of dicamba are discussed in the sections that follow.

UNCERTAINTIES

There is a lack of data on the effect of dicamba to green algae as well as a lack of data on chronic effects of dicamba to freshwater and saltwater fish and invertebrates. In the absence of data, risk to these taxa has been assumed.

Based on the usage of other herbicides associated with genetically modified crops that are tolerant to a specific herbicide (*e.g.,* glyphosate-tolerant soybean), the use of dicamba on soybeans [lbs acid equivalent (a.e.)/year] could potentially increase when compared to past usage data from this new use. This is due to a variety of factors including the fact that once a tolerant crop is grown in a particular area, the use of the tolerant crop is often adopted by neighbors (to minimize the potential risk from spray drift). Additionally, dicamba use on tolerant soybeans is predicted to increase given the recent resistance issues identified in glyphosate-tolerant soybean (J. Tooker, D. Mortensen, and F. Egan, pers. comm., Nov. 2010; Mortensen 2010). Although EFED does not typically address specific concerns related to the increased usage of a chemical, the potential for ecological risks likely increases with increased usage. BEAD should be consulted on the potential for increase use.

Additionally, applications during a warmer time (*i.e.*, post-emergence) may increase off-site transport (via volatility) during a time when many plants have leafed out (J. Tooker, D. Mortensen, and F. Egan, pers. comm., Nov. 2010; Mortensen 2010). Therefore, a post-emergence application may increase the likelihood of effects to non-target plants through habitat loss. This could indirectly affect those organisms which rely on those plants, including pollinators, through this is uncertain and requires additional evaluation.

It is also possible that the proposed new use of dicamba on dicamba-tolerant soybeans may increase the occurrence of weeds that are resistant to dicamba. The occurrence of weed resistance to glyphosate has increased significantly since the adoption of transgenic glyphosate-resistant crops (Powles, 2008). Prior to development of glyphosate-resistant crops, there were no known cases of evolved glyphosate-resistant weeds (Dyer, 1994). There exists potential that a similar pattern of rapidly evolving weed resistance to dicamba could occur where transgenic dicamba-resistant crops are used.

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